

IV. *Notes on Heterogynis canalensis*, n. sp. By DR.
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PLATES XI, XII, XIII, AND XIV.

AT the end of June and beginning of July last year (1903) Mr. Champion and I met with a species of *Heterogynis*, at Canales de la Sierra, which we took at first for *Heterogynis paradoxa*, but which is really very close to *H. penella*, and has fewer points in common with *H. paradoxa* than with *H. penella*.

It was attached to *Genista scorpius*, a plant that looked, to my eyes, very much the same as the common *Calycotome* of the Riviera, whenever at any rate it was allowed to grow at all freely; usually, however, it was so browsed down by goats, sheep, and other animals, that it took the form of little rounded bushes a foot or two high, that were little better than very solid bundles of thorns. The grazing must be done entirely during the growing season, when some of the shoots that protrude are soft and succulent. I regarded as a most ungrateful task, the getting a portion of this plant and carrying it home for the food of larvæ.

There were several other *Genistas* at Canales, chiefly a tall handsome species, which I do not think was *Genista florida*, but was certainly in habit and general appearance very like it. Another, which I took to be *C. scoparius*, was also common.

I think I got one odd larva of *Heterogynis* from the *C. scoparius*, but, with this exception, not a specimen was found on anything but the *G. scorpius*. This close attachment to one plant was one of the items that made me at first think I had *H. paradoxa*. My experience of *H. paradoxa* is that it will eat nothing but broom, and as a rule only one species of broom in each locality. *H. penella* on the other hand will eat almost any leguminous plant, and even a good many others.

We met with various "brooms" at different parts of our excursion, and I searched this Florida-like species

thoroughly at Barbadillo, at Canales, and at Moncayo, and it, and others more superficially at other points of our journey, but nowhere else did *Heterogynis* occur than at Canales, and then only on the *G. scorpius*. This plant was a favourite food of *Orgyia aurolimbata*, and a considerable number of Geometers occurred on it; of these I only bred one or two, which proved to be *H. coronillaria*, *Euconista miniosaria*, and *Hybernia bajaría*.

This *Heterogynis* is in many respects very close to *H. penella*; as an imago it has a few points of distinction, which are probably quite trivial. On the larva the minute coronetted tubercles are slightly but definitely and constantly different from those in *H. penella*. There is, however, a remarkable difference in the habits of pupation of the female larva, and consequently in the habits of the imago, that appear to compel one to regard it as specifically distinct. Should any one prefer to regard it as a local race of *H. penella*, I should consider his personal equation in the matter, as being less typical than my own, but not as being of a very aberrant variety. I propose for the species the name of *Canalensis* from its habitat.

The ♂ imago has more the general facies of *paradoxa* than of *penella*, it is larger than *penella*, viz. 22 mm. against *penella* 20 mm., and is very constant at this expanse. It is nearer *paradoxa* than *penella* in the form of the wing, the hind margin being more oblique than in *penella*, less than in *paradoxa*, that is, the inner margin is definitely shorter than the costal, to a greater degree than in *penella*.

The fringe is decidedly shorter than in *penella*, viz. as 10 to 11, just the reverse of their wing expanse, at same point, 0.60 mm. to 0.66 mm., and the whole insect has a specially smoothed brushed-down aspect when beside *penella*.

It differs from both the other species in coloration. In these species both wings are very similar in coloration, but in *canalensis* the upper and under wings contrast with each other in the way that is so much more usual in *Heterocera*. The upper wing has something of the dove colour of *paradoxa*, var. *candelariæ*, whilst the hind one is decidedly darker.

In view of the slight differences between the species of *Heterogynis* as imagines, it has often occurred to me to reflect, that in Lepidoptera generally, specific differences are very frequently confined to small differences of marking or colour, but in *Heterogynis* both marking and colour are

wanting, and so specific differences that might have been detected in this way have no means of expression.*

The genital armature of *H. canalensis* differs in no respect that I have been able to discover from that of *H. penella*. In both the apex of the *tegumen* is pointed, whilst in *H. paradoxa* it is bifid at the apex.

It also agrees with *H. penella*, in the larva in its first skin being without the stellate or coronate, secondary tubercles, which are present in *H. paradoxa* at hatching, and in both species are conspicuous in all the further larval stages (Plate XII).

In the full-grown larva, these curious points (photographed in Ent. Trans. 1902, Plate XXVIII, as they appear in newly-hatched *H. paradoxa*) are very different in *H. paradoxa* from the other two species, those of *H. penella* and *H. canalensis*, more nearly resemble each other. Though thicker and more robust than in the others, the coronets are in *H. paradoxa* only about half the size they attain in the other two species. The large spines are short and thick, about 0.03 mm. long, and the smaller or secondary spines are short blunt teeth, very few in number.

In *H. penella* the tubular base is larger and more cylindrical than in the others, and the long spines are seen to arise rather from its outer surface than from its margin; they do not widely diverge, they are about twice as long as those of *H. paradoxa*; the smaller or secondary spines are numerous, long, sharp and needle-like, and arise from the margin of the tubular portion, and may be seen passing round their margin, inside the larger spines.

In *H. canalensis* the form is more like that of *H. paradoxa*, the size that of *H. penella*. The base is wide and salver-shaped, the large spines spreading, and the secondary ones are even shorter than *H. paradoxa*, so short and blunt as often to appear to be absent.

These coronets vary very much in size in all the species, but between the species they not only compare generally as above noted, but the same differences are observable when those nearest in size and form are compared.

On comparing those of *H. penella* and *H. canalensis*, those of *canalensis* always have the tubular portion more open and salver-shaped, in *penella* it is straighter and more

* I see Professor Poulton in the President's address (Trans. Ent. Soc. 1903, p. lxxxii, lxxxiii) presents a very similar reflection, though with a somewhat different application in view.

tubular. In both, the long spines appear to arise rather just outside the upper rim than from its margin; in *H. penella* the rim often very distinctly passes round inside the long spines, and has short spines along this margin. In *canalensis* the margin rather folds over to the spine, or the inner surface of the spine opens out to either side into the margin, which inclines to fold inwards a little, and has irregularities rarely amounting to short blunt teeth, whilst the margin in *penella* is usually armed with a continuous series of long fine needles.

The cocoons of the three species of *Heterogynis* present good differential characters (Plate XI).

In *H. paradoxa* ♀ the cocoon is much larger than that of *penella*, and instead of being lemon-yellow is bright reddish. The larva spins first an outer delicate lace-like layer, beginning at the surface of attachment and spinning outward on each side a net-like veil, unites these above when they are large enough to meet. Within this is the true inner cocoon, which is similar to the outer one, but hardly as dense and strong; it is not far within the other, the space between being occupied by a comparatively slight web of connecting silk. The outer cocoon is more net-like than a mere fortuitous disposition of the silk would produce, there being numerous net-like holes, the margins of which consist of numerous strands of silk, giving the impression that the silk of *paradoxa* is coarser than that of the other species; it does not, however, appear really to be so.

The ♀ cocoon of *H. paradoxa* consists then of a definite separate net-like outer layer and an inner layer less dense and slung within the outer one by somewhat abundant threads, the inner and outer layer being frequently so far separated from each other, that the thickness of the wall of the cocoon may be from 3 to 5 mm. The ♂ *paradoxa* cocoon appears to have the same structure, but it proves practically impossible to separate it into two layers.

The ♂ *H. penella* cocoon is much the same as that of *H. paradoxa* ♂ as regards divisibility into layers, but agrees with the ♀ *H. penella* in the silk being fairly uniformly distributed, there being little or no aggregation into strands to form a network. The ♀ *H. penella* cocoon is comparatively small, looks fluffy, with outside silken threads, instead of smooth as in *H. paradoxa*, so that the method of spinning is probably different. I have not seen *H. penella* spinning its cocoon. It places it, however, like *paradoxa*

does, by preference, on a stem or stalk and not between two or more surfaces. Its structure looks uniform and the thickness of the wall of the cocoon is trifling, on section, however, it is found to consist of an inner and outer layer, closely fitting together, but with less connecting silk than the two separated but less definite layers of *H. paradoxa*'s cocoon are united by.

The cocoon of the male of *H. canalensis* is not unlike that of *H. penella* ♂, that of the ♀ is very different. In the first place, it is never laid along a twig or stalk as is the typical position of the ♀ cocoon of the other species and of all the males. It is sometimes found amongst the thorns of the food plant, but perhaps more frequently under stones adjacent to the feeding place. It is necessary to it to have support on several sides. It is very large, 25 to 35 mm. long, 22 mm. across, and more or less in the third dimension according to its situation, against 25 × 13 × 13 mm. for a large *H. paradoxa*, or 16 × 8 × 8 for a well-sized *H. penella*. This outer cocoon often has some external spinning to fix it to its place of attachment, under (or between) stones, one side (or two) is attached to the stone. It is thin and transparent but very closely woven, and probably proof against a good many enemies. Centrally in this outer cocoon is an inner one that looks much like the ordinary cocoon of *H. penella*, but is frequently a good deal larger (17 or 18 mm. long, 16 being large for *penella*).

What are the homologies of this cocoon? When I first met with it, having only memory and no specimen by which to compare it, I thought it must be a variation of the cocoon of *paradoxa*. This, however, it certainly is not. The manner of spinning is that of *penella* and not of *paradoxa*. The colour does not at all agree with *paradoxa*, indeed it is paler than that of *penella*. It is rather a faintly flesh-tinted white than anything of the yellow of *penella*.

When one examines the inner cocoon, it is found to consist of two layers like the cocoon of the other species, but they are a little less easily separated.

The outer cocoon, then, is an entirely new structure not represented in the cocoon of either *H. penella* or of *H. paradoxa*.

This conclusion is fully confirmed when the function it fulfils is considered. It is a continuous envelope with-

out opening, valve, or weak place; the inner cocoon has the same valvular opening at top that the cocoons of the other species have, and through which the pupa partly emerges and again retreats. When this emergence of the pupa of *penella* and of *paradoxa* takes place, it comes into the open air, and the ♀ then emerges and finds herself fully exposed. But in the case of *H. canalensis* when the female emerges, she is still within the chamber formed by the outer cocoon. The position into which she emerges is free from any silken cords which elsewhere suspend the inner cocoon safely in the centre of the apartment formed by the outer cocoon.

When the male arrives he has to thrust his abdomen through such openings as he can make or find in the outer cocoon. I have twice seen this pairing take place, but could not be sure whether he had to discover some particular spot or whether almost anywhere at the right end of the cocoon was practicable. In other cases the male failed to reach the female, but this was probably due to the artificial conditions of my observations; the cocoon, not being left *in situ*, the right place would be difficult to find, and with cocoons spun in captivity, other larvæ spin over them, so as to destroy the proper structure.

The anal armature of the ♂ is well calculated to pierce such a web as the outer cocoon, and the movement for doing so, is very similar to that used by *penella* and *paradoxa* in finding their goal by searching over the smooth surface of the moth.

There can be no question that *Heterogynis canalensis* has a much more severe struggle for existence than the other two species; except perchance the *candelariæ* var. of *H. paradoxa*, which certainly concealed itself at all stages in a marvellous way, without varying in any very material degree from the other sub-species in order to secure this result. Taking *canalensis* as being close to *penella* we find it confines itself to a plant that is a solid mass of thorns, the female retires to form her cocoon to a place in the interior of the bush where thorns are especially thick and brittle, more rarely spinning in the centre of a living bundle of thorns. More frequently than remaining in the bush, she wanders to find a place under the bush amongst stones, which are usually plentiful enough where the *G. scorpius* grows, and in such stony places the *H. canalensis* is rather more frequent. We

often found several cocoons together in places under stones, sometimes half-a-dozen or more, usually all but one or two, rarely more, being old ones, looking indeed much like the new ones, except that the fine silky lustre of the fresh cocoon was wanting.

These habits seemed to render it practically impossible that birds, lizards, or such enemies should attack the species with any appreciable success, yet it is certain that Dipterous parasites and some Hymenoptera made great havoc amongst them, and of the old cocoons found under stones a very large proportion (two-thirds or three-fourths) contained the remains of a larva or pupa that had died apparently from such attacks. It was common in my boxes for one larva to spin over the cocoon of another in a way that was fatal, but I never found an unmistakable instance of this in the open.

In considering whether this species is or is not truly distinct from *H. penella*, several reflections occur. Chiefly it seems tolerably certain that a male of *H. penella* could not normally pair with one of *H. canalensis*, and it is doubtful whether a male of *canalensis* would successfully approach one of *H. penella*. This, in addition to the points I have already referred to, leads me to consider them distinct.

Of course the question of whether they are distinct species or not does not affect the interest attaching to the remarkable differences in habit. Whether in their divergence the two forms have or have not passed the point at which sub-species become species is no doubt a question of fact, they either have or they have not, but as the materials for definitely settling the point are wanting, we can only form an opinion from the available facts.

The species was plentiful enough at Canales, and though we did not see it, it probably occurs in various other places in this mass of Sierras, but it must be well segregated from other colonies of the genus as the Sierra is well surrounded by wide areas quite unsuitable to any *Heterogynis*.

For Explanation of Plates see next page.

EXPLANATION OF PLATES.

PLATE XI.

COCOONS of HETEROGYNIS.

- FIGS. 1-3. *Heterogynis penella*.
1. Males.
 2. Females.
 3. Female cocoon cut open and inner cocoon partially pulled out.
- 4-7. *Heterogynis paradoxa*.
4. Males.
 5. Females.
 6. Female cocoon cut open and inner cocoon partially pulled out.
 7. Cocoon before spinning of outer cocoon is quite completed.
- 8-16. *Heterogynis canalensis*.
8. Males with pupa cases attached.
 9. Males without " "
- 10-14. Females as made in varying situations.
15. Female cocoons in which the moths have died (and shrivelled) in the position of emergence showing them to be within the (special) outer cocoon. The unpleasing effect of the ill-managed (artistically) light background, must be excused, as it is effectual for its purpose of showing the situation of the moth.
 16. Female cocoon, outer (special) cocoon (1) torn open and inner one (2) slit, and extreme inner one (3) removed to side, showing that the two inner (2 and 3) correspond to the outer and inner in the other two species.

PLATE XII.

Larval tubercles (coronetted) of HETEROGYNIS.

- FIGS. 1-4. *Heterogynis paradoxa*.
1. First instar, tubercle. $\times 400$. First instar *penella* and *canalensis* are without these tubercles.

FIGS. 2, 3, 4. Tubercles of last stage larva. $\times 250$. Compared with other species they look thick and strong, and are short, about half their length. The short spines are very distinct, but short and obtuse.

5, 6, 7. *Heterogynis canalensis*.

Tubercles in last instar. $\times 250$. They are wide, open and shallow, consequently many, in a prepared specimen, present themselves as fig. 6, opened out flat. The smaller spines are often absent, and when present are always few, short and rounded.

8-13. *Heterogynis penella*.

Tubercles in last instar. $\times 250$. The basal or tubular portion is longer and narrow, may be nearly cylindrical, never so widely salver-shaped as in *canalensis*; in preparations, an open flattened one, as fig. 9, is rare and always distorted. The short spines are numerous, sharp, long and needle-like.

PLATE XIII.

View of Canales de la Sierra (Province of Logroño) from the W.N.W., below a spur of the ridge to the North of the Valley. The distant point is to the North of the Cebollera.

PLATE XIV.

Rough sketch map of the Sierra district between Burgos and Saragossa to give some idea of the position of Canales de la Sierra.